

AT&T Mobility

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AT&T's Wireless Business

- 2G network turned down as of January 1, 2017
- U.S. smartphone market reached saturation
- Data on our mobile network has increased about 250,000% since 2007
- ARPUs Falling
- Return of Unlimited Data
- Software Defined Networks (SDN) and Network Function Virtualization (NFV)
- Purchase of Time Warner Entertainment
- 2 ➤ 5G on the horizon, shortening life cycles of 3G and 4G



Turndown of AT&T 2G Network is a Done Deal

- ***“To help support the massive growth of mobile internet usage and free up spectrum for newer technologies, Service discontinued on 2G network on Jan. 1, 2017”*** – John Donovan, *Chief Strategy Officer and Group President – AT&T Technology and Operations*
 - Spectrum needed to be shifted as data usage on the network has increased 250,000% between beginning of 2007 and end of 2014.
 - Companies must change millions of 2G devices, costing several billion dollars.

3G Turndown is on the Way

- **UMTS also displays characteristics of an obsolete technology**
 - Many of AT&T’s UMTS carriers have already been turned down to free up spectrum for LTE.
 - 3G likely to be shut turned down in the 2020 timeframe. Then only LTE and 5G
 - LTE will cover 99% of the population by 2017.

Source: “AT&T to shut down 2G GSM network by Jan. 1, 2017”, Sean Kenny, March 24, 2016.

Source: Chris Dunphy, “The End is Coming: AT&T Reminds Customers About Upcoming 2G Network Shutdown”, March 28, 2016.



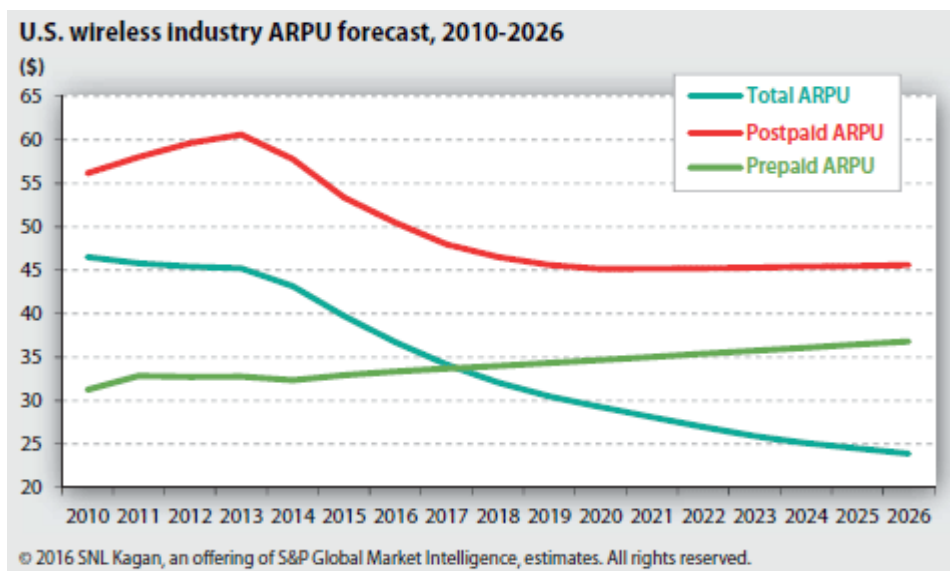
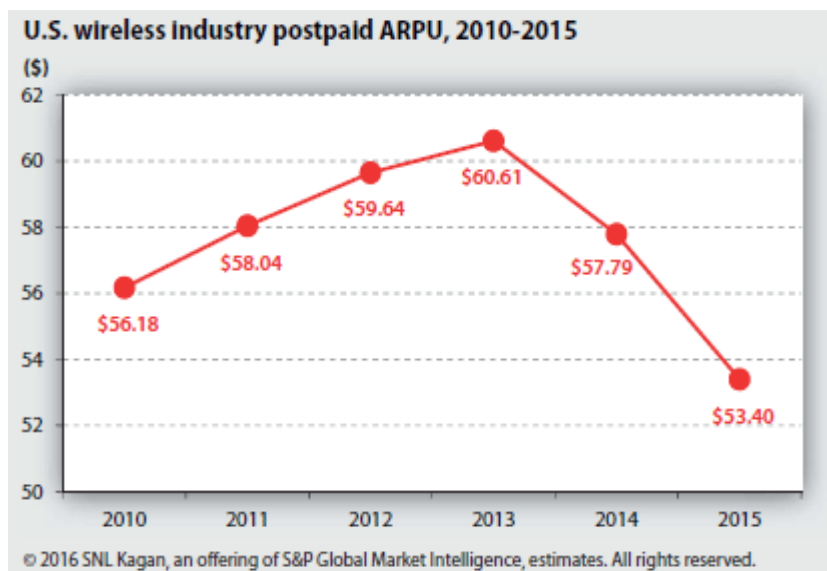
A Steady Deterioration of AT&T's Wireless Business

- The two largest carriers in the U.S., AT&T and Verizon have had to look for growth elsewhere
- The wireless market is reaching its saturation point.
- With AT&T 's intention to buy Time Warner and Verizon's uncertain future with its recent purchase of Yahoo, the wireless industry is losing its status as one of the 'darlings' of the growth sectors.
- Consistent erosion in the U.S. wireless market has prompted AT&T to move aggressively into digital media and advertising.
 - *“They need to find a path forward for their core U.S. business that offers something better than inexorable decline. The internet, mobile phones and smartphones fueled rapid growth, but for the first time in memory, **there is no ‘next big thing’ in telecom.**”* – Craig Moffett, MoffettNathanson Research



Decline in ARPU

- Peaked in 2013, 24 months later, the metric sank by \$7.21 to \$53.40 as carriers moved away from the 2 yr. contracts.
- Total ARPU is expected to shrink over the next decade as more low-ARPU devices come online.



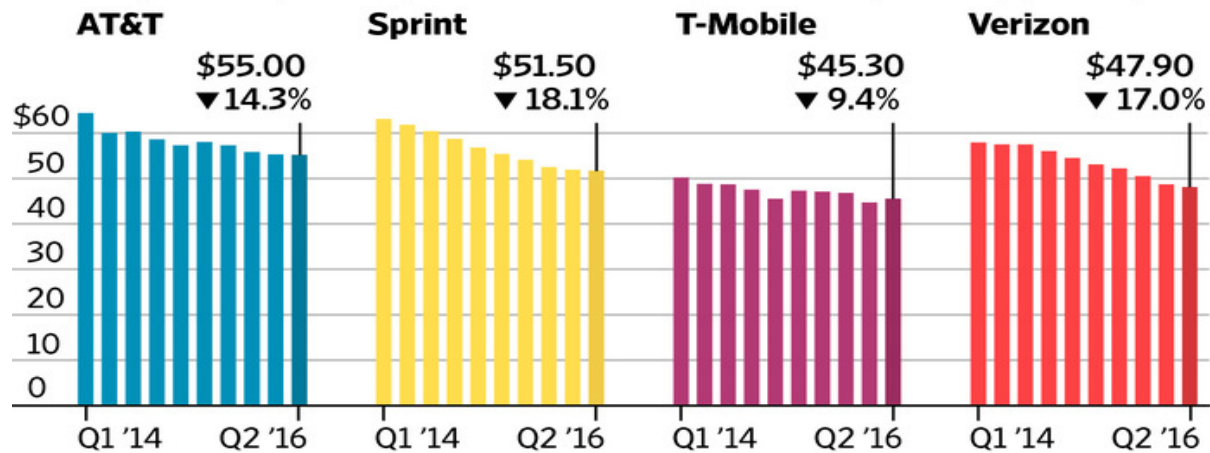
Source: Mobile projections through 2026, SNL Kagan, October 21, 2016.



The Wireless Market is Saturated

Dropping Lines

Average revenue per user has declined for the big four wireless carriers, due in part to price wars. Average revenue per user, quarterly:



Source: UBS AG

THE WALL STREET JOURNAL.

Source: Telecoms Consider Fee Hikes, as Fierce Price War Plays Out, Thomas Gryta, July 31, 2016.



Deterioration of AT&T's Wireless Business (Contin)

- U.S. smartphone market reached saturation, significantly slowing the rapid growth of the industry
- Leading AT&T to agree to spend \$49 billion to acquire DirecTV.
- AT&T's wireless business has continued to decline since the DirecTV deal closed, losing a “shocking” 1.4 million postpaid phone subscribers over the last year.
- Postpaid ARPU continue to slide, and service revenue growth “has remained stubbornly weak.”
 - *“What AT&T saw in the wireless business was a steady deterioration in both its own market position and the industry itself. DirecTV's free cash flow was a welcome stopgap for the dividend. But since AT&T announced its agreement to acquire DirecTV in 2014, results in both wireless and AT&T's Pay TV segment have weakened considerably. It is reasonable to assume that the decision to buy Time Warner would otherwise have come only years after a deal the size of DirecTV. Instead, AT&T was forced to go back to the well just fifteen months after the DirecTV deal had closed.”* – Craig Moffett, MoffettNathanson Research

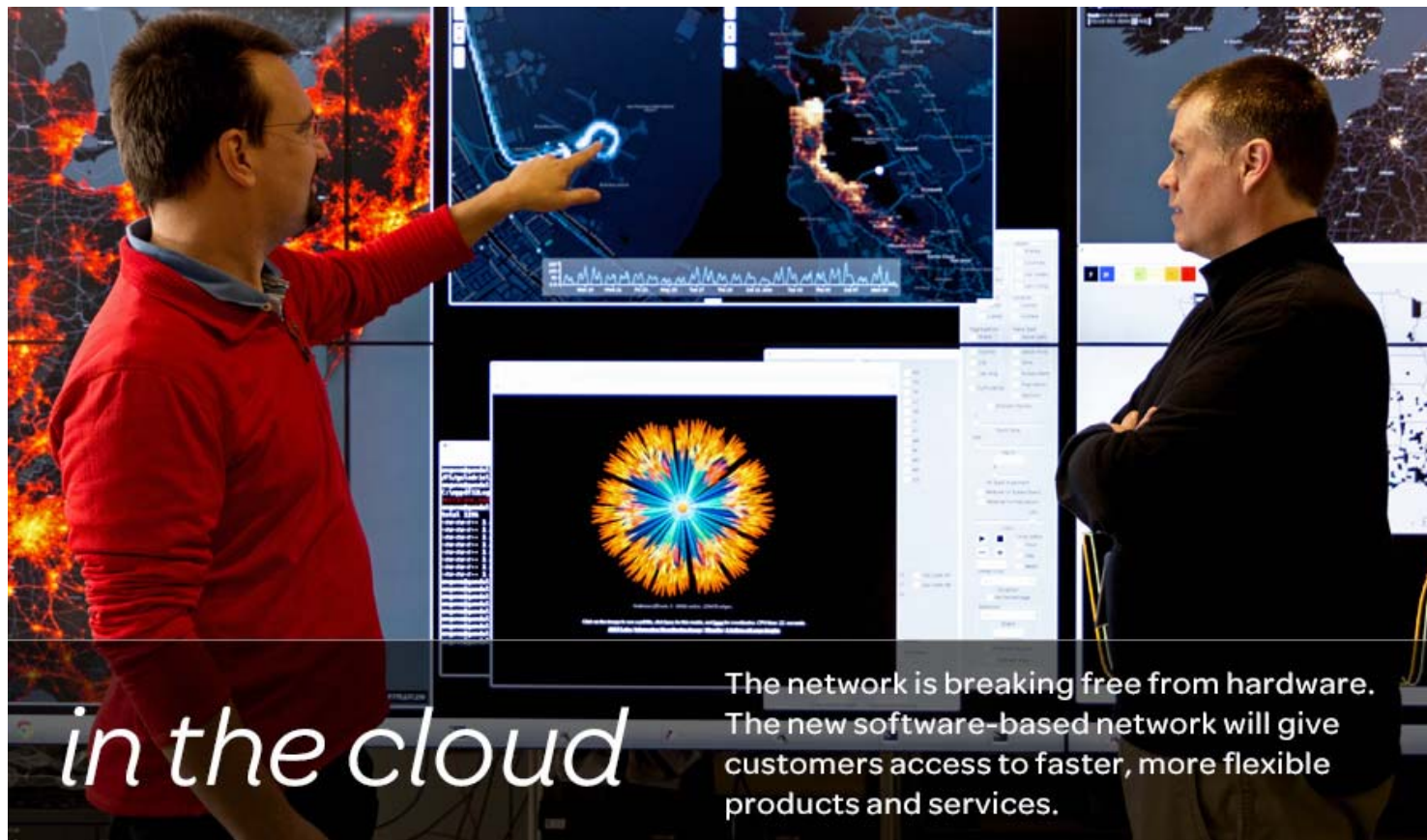


Deterioration of AT&T's Wireless Business (Contin)

- In its 3Q earnings report,
 - Business Solutions business grew a measly 0.4%,
 - Video subscriber base shrank by 0.5% YoY
 - Broadband subscriber base decreased by 1%.
- Even consumer mobility – the segment that was supposed to be AT&T's growth engine – came in with a 5.9% decrease in total revenues in the quarter.
- **MoffettNathanson said AT&T had to do something to secure its future.**
 - *“With its back-to-back acquisitions of first DirecTV and now Time Warner, **AT&T is seemingly walking...no, running...from its wireless and wired roots.***
 - *For the first time in memory, there is no ‘next big thing’ on the horizon....*
 - *They need to find a path forward for their core U.S. business that offers something better than inexorable decline.”* – Craig Moffett, MoffettNathanson



SDN – A Network Built On Software



SDN Progress

- **Virtualize 75% of network by 2020 and run most of the network functionality on “white box” computers in data centers.**
 - **Virtualized 5.7% in 2015**
 - **Virtualized 34% of our network by the end of 2016**
- **Provides ability to add features quickly and reduce operational costs**
- **Provide customers the ability to customize their own network**

Source: AT&T Networking Exchange Blog, Richard Tanner, November 7, 2016.

AT&T Uses RADCOM'S Innovative Technology to Transform Its Network, AT&T Newsroom, August 2, 2016.



Transformation of the Network Equipment with SDN

- **In a short time 75% of the functionality of the network will be running on generic white box computers**
 - Much cheaper to buy than specialized telecommunications hardware
 - Support far greater network functionality and speeds
- **Computers that sit in data centers somewhere a state or two away**
- **Wireless edge core switching centers will be substantially underutilized**
- **With turn down of 2G networks and eventually discontinuing 3G Edge switching centers will be largely obsolete**



The Search For Growth Through **ACQUISITIONS**

- **Last year the big news was acquisition of Direct TV and the investments in lusacell and Nextel Mexico**
 - Idea was to use use Direct TV and the larger footprint into Mexico and Latin America to put Direct TV content over wireless phones
 - **AND GROW**
- **This year its all about the Time Warner Acquisition**
 - \$108.7B (\$85.4B Equity)
 - Expected to be accretive in the first year after close
 - Deal to improve dividend coverage and enhance revenue & earning profile
- **Allowing AT&T to put all that content over wired and wireless networks**
- **Ability to provide customers whatever they want over any medium**
- **Become a media giant and grow**



Internet of Things (IOT)

- **AT&T expects 50 billion "things," or connected apps and hardware by 2020**
- **In 2016, AT&T signed over 500 new IoT deals in the U.S. & globally**
- **As of Q3, 2016 – 300 million connected devices on our network**
- **Connecting more than 10 million cars and 22 of the top global car brands in the U.S. and abroad, which makes AT&T an industry leader**
- **Digital Life - – professionally monitored smart home security and automation service**



5G Coming, Shortening 3G and 4G Lifecycles

- **Ericson AB expects 5G deployment in second half of 2017.**
 - *"The shift to 5G will be as profound as the move from analog to digital,"* - Murthy Renduchintala, president at Intel
- **AT&T Inc. has reached speeds of up to 14 gigabits a second in lab trials of 5G wireless technology, and**
- **AT&T plans to test the high-speed network by beaming its DirecTV Now video service to homes in Austin, Texas before midyear.**
- **AT&T to offer the first commercial so-called point-to-point 5G service in 2018.** - John Donovan, AT&T's chief strategy officer
- **Tom Keathley of AT&T estimated that we could see the beginning of a major 5G network in 2017, and something more concrete and usable as early as 2018.**

Source: CNET "AT&T doubles down on 5G with second test location", Roger Cheng, June 5, 2016.



LTE Advanced

- **AT&T - 1 Gbps Speeds in 2017**
 - 1 Gbps download, 500 Mbps upload
 - Made possible with Carrier Aggregation (CA), enhanced use of multi-antenna techniques and support for Relay Nodes (RN).
 - currently deploying three-way carrier aggregation in select areas with plan to introduce four-way carrier aggregation



More Competition for Wireless Services

Google

- Project Fi – wireless service, cost \$20 per month for talk and texts including WiFi hookups and international coverage in more than 120 countries - very competitive pricing
- Project Loon – solar powered balloons at an altitude of 60,000 to 90,000 feet that are capable of beaming internet access down to earth
- Project Titan – testing drones and satellites capable of delivering internet access

Cable Companies

- Cable operators will claim 10% of the U.S. wireless market by 2020, New Street Research predicted
- Comcast and Charter plan to join the wireless market by leveraging their network of Wi-Fi hotspots
- They will market mobile services within their existing footprint, bundling wireless with their existing TV, internet and landline phone services.



Emerging Competition from Cable Operators

- Cable operators will claim 10% of the U.S. wireless market by 2020, New Street Research predicted, stealing most of those customers from the biggest wireless carriers.
- Comcast plans to join the wireless market this year, leveraging its network of 15 million Wi-Fi agreement with Verizon.
 - They will market mobile services within their existing footprint bundling wireless with their existing TV, internet and landline phone services.
- Charter has continued to plot its entry to the market and has asked Verizon to activate the MVNO agreement and couple that deal with its network of Wi-Fi hotspots.
- The two companies—and other cable operators—will combine to capture 23 million wireless customers by 2020.
- T-Mobile and Sprint are “relatively insulated” and may actually benefit from increased competition.
- The nation’s two largest mobile network operators are vulnerable.
- hotspots and a 5 yr. old MVNO

Source: Verizon, AT&T set to lose 9M customers to cable operators by 2018, New Street says, Colin Gibbs, November 23, 2016. *“Comcast will be marketing an offer by the middle of next year; we expect Charter to be a couple of quarters behind. If carriers lose share proportionately, AT&T and Verizon stand to lose 9 million subs by the end of 2018. T-Mobile and Sprint would do worse than we expect, but perhaps not much worse than consensus expects. The incumbents may bear even more of the losses given their dominance at the high end of the market where cable companies will be focused.”* – New Street Analysts



MoffettNathanson: Cable's infrastructure will ultimately win in wireless



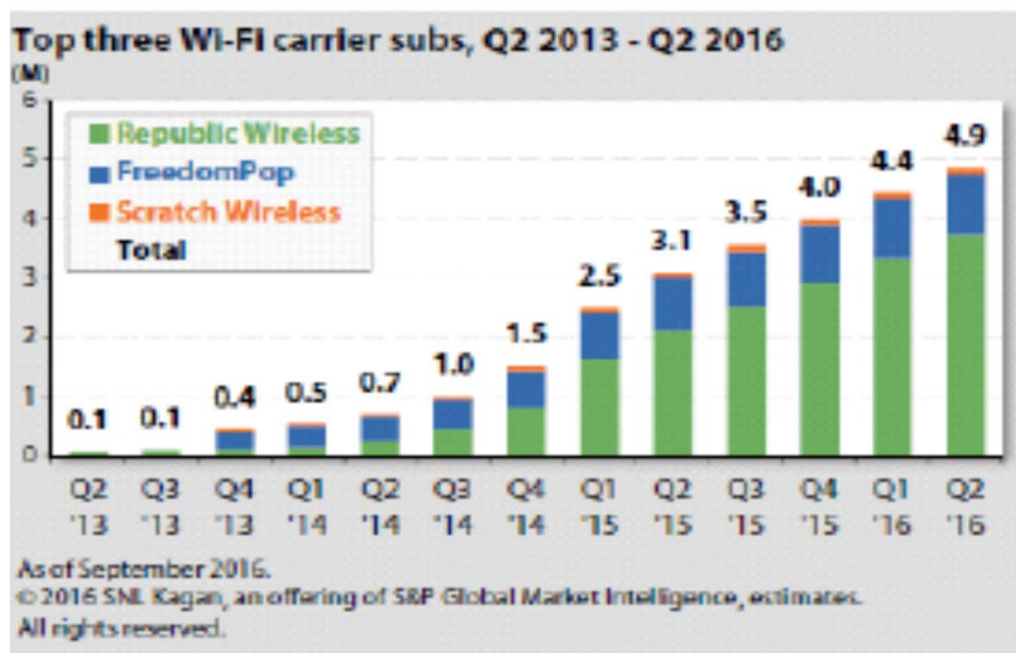
And Cable Will Win

- The cable industry claims the densest wired networks in the nation, so cable operators have something of an advantage. Meanwhile, users are increasingly turning to mobile devices to access fixed-line networks.
 - *“Cable will be in the wireless business whether they like it or not. Becoming a full-fledged wireless network operator is not a choice... it is a necessity. Cable's infrastructure will ultimately win in wireless, just as it has already won in broadband.”* – Craig Moffett, MoffettNathanson Research
 - *“The industry is already too crowded, and if networks really do begin to take on the economic character of wired networks, we know from experience that the sustainable number of networks will necessarily fall. As we have articulated in this report, **we believe Cable will be one of the winners. That leaves four wireless operators vying for what might only be one, or perhaps at most two, additional spots to fill.**”* – Craig Moffett, MoffettNathanson Research



More Competition is on the Way

- With second-quarter subscriber totals approaching 5 million, Wi-Fi carriers including Republic Wireless, FreedomPop, Scratch Wireless and Google Inc.'s Project Fi are disrupting the U.S. wireless ecosystem, according to SNL Kagan estimates.
 - Notably, Project Fi and Republic Wireless stand out as forces to be reckoned with in U.S. wireless with competitive pricing models for data.



Source: SNL Kagan, Wi-Fi carriers disrupt US wireless in 2016, September 21, 2016.



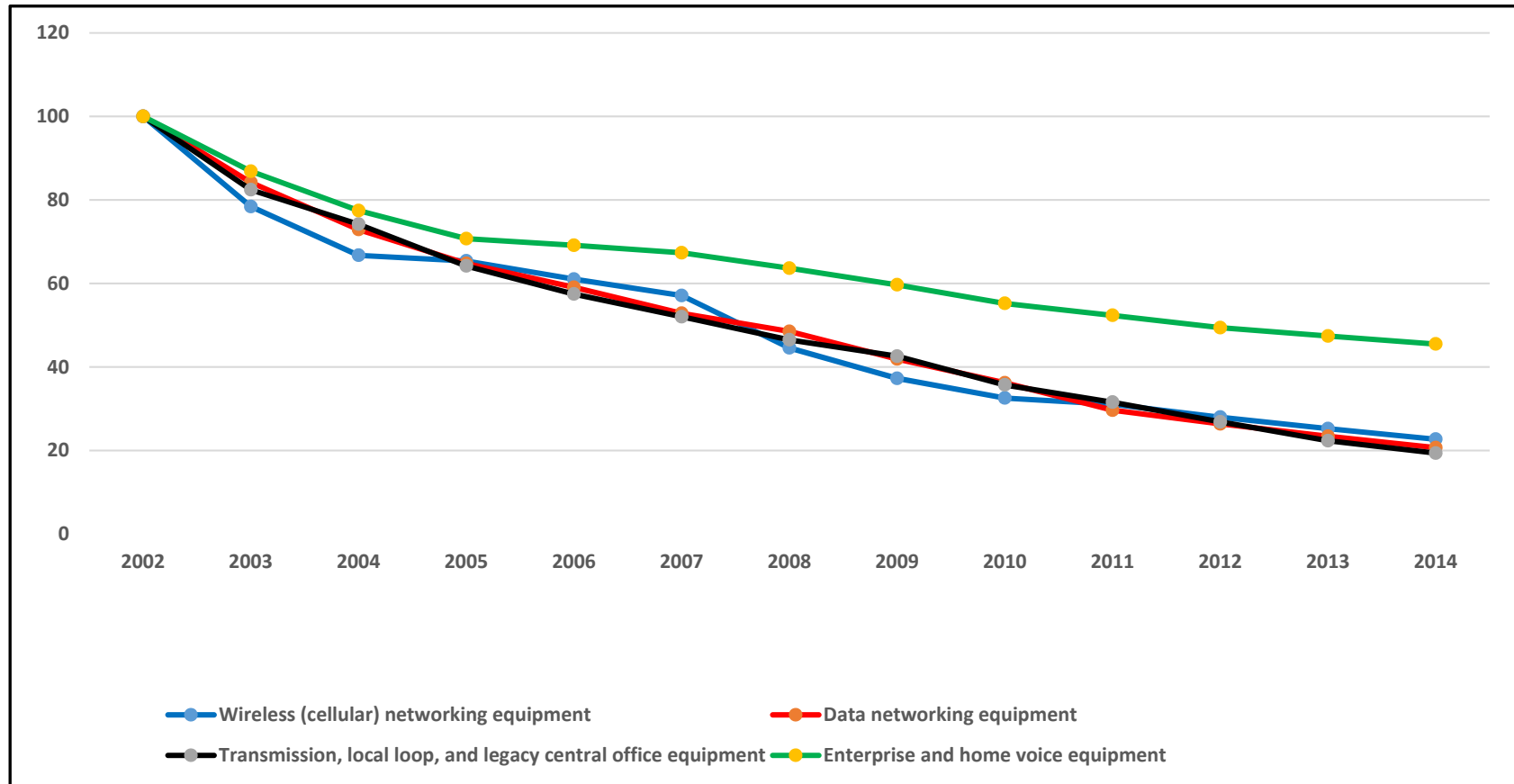
Declining New Equipment Prices

Year	Wireless (cellular) networking equipment	Data networking equipment	Transmission, local loop, and legacy central office equipment	Enterprise and home voice equipment
2002	100	100	100	100
2003	78.421	84.193	82.442	86.867
2004	66.743	72.919	74.186	77.444
2005	65.392	64.792	64.199	70.729
2006	61.029	59.077	57.458	69.143
2007	57.098	52.839	52.041	67.347
2008	44.562	48.512	46.492	63.662
2009	37.281	41.914	42.588	59.681
2010	32.567	36.211	35.712	55.224
2011	31.079	29.646	31.570	52.364
2012	27.983	26.375	26.866	49.420
2013	25.242	23.413	22.344	47.417
2014	22.703	20.680	19.382	45.497

Source: Board of Governors of the Federal Reserve.



Federal Reserve Product Price Indexes – Communications Equipment



Source: Board of Governors of the Federal Reserve.



